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Crustose lichens new to India

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Abstract—*Bacidia pycnidiata* (*Ramalinaceae*), *Malmidea nigromarginata* (*Malmideaceae*), *Porina malmei* and *P. nuculastrum* (*Porinaceae*), and *Pyrenula laetior* and *P. wrightii* (*Pyrenulaceae*) are reported for the first time from India. The specimens were collected from the state of Assam. Taxonomic descriptions, distributions, and illustrations are provided for each species.

Key words—biodiversity, lichenized *Ascomycota*, Nagaon, taxonomy, Tezpur

Introduction

Lichens constitute a significant part of India's biodiversity, and 2714 lichen species are known from the country (Sinha & al. 2018). Although lichens occur everywhere in India, ecological studies reveal that Northeast India, Western Ghats, Western Himalaya, and Andaman & Nicobar Islands are the major centres of diversity (Nayaka & Asthana 2014). Assam, a state of Northeast India, possesses the heterogeneous climatic conditions that make it suitable for rich floral, faunal, and fungal diversity. Over 325 species (in 83 genera and 27 families) have been reported from Assam (Gupta & Sinha 2018, Gogoi & al. 2019). Here we record six additional lichen species (in *Malmideaceae*, *Porinaceae*, *Pyrenulaceae*, and *Ramalinaceae*) new to Assam and to India.

Materials & methods

The present study is based on the freshly collected lichen samples from Assam. The lichen specimens were dried, preserved, and deposited in the herbarium at CSIR-National Botanical Research Institute, Lucknow, India (LWG). The lichen thallus was morphologically examined under a Leica EZ4 stereo zoom microscope. Thin hand-cut sections of ascus and thallus were mounted in distilled water, Lactophenol Cotton Blue (LCB), 5% KOH, or Lugol's iodine solution for observation under a Leica DM 2500 compound microscope. The thallus and ascomatal tissue were spot-tested with K (5% KOH aqueous solution), C (aqueous Ca(ClO)2 solution) and P (0.5 g of para-phenylenediamine dissolved in 5 ml of ethanol) following Orange & al. (2001). Thin Layer Chromatography was performed in solvent system C (toluene: acetic acid; 85: 15 ml) following Orange & al. (2001).

Taxonomy

Bacidia pycnidiata Czarnota & Coppins, Lichenologist 38: 407. 2006 Pl. 1a

Thallus epilithic, pale yellowish to greenish, slightly granular, cracked. Apothecia few, 0.2–0.4 mm diam. Excipulum prominent, colourless, 90–140 µm wide. Hymenium hyaline, 40–55 µm high, I+ blue. Asci cylindrical, *Bacidia*-type, 35–41 × 4.5–5.8 µm. Ascospores acicular, 3(–7)-septate, 25–38 × 1.2–2.8 µm. Pycnidia very few, having round flask shaped bottom with long neck, 0.1–0.2 mm diam., constricted at base, concolorous with apothecia, neck slightly paler than bottom, ostiole present at the tip of the beak; conidia hyaline, 3–5-septate, straight to slightly curved, filiform, 37–62 × 0.4–1.0 µm.

Chemistry—Thallus K–, C–, P–, UV–; no chemicals detected in TLC.

Specimen examined—**INDIA**, **Assam**, **Tezpur**, Ouguri Hills, 26°37′03″N 92°46′37″E, elev. 113 m, on rock, 16 May 2015, Manas P. Choudhury 15027001 (LWG 35885).

Remarks—The ascospore length of the Indian specimen is slightly shorter than that given in the protologue of *Bacidia pycnidiata* (35–52 µm; Czarnota & Coppins 2006). Further, the Indian specimen had occasional 7-septate ascospores rather than the usual 3-septate, which has not been reported previously for *B. pycnidiata*. In all other aspects the Indian specimen agrees with the published description of *B. pycnidiata*.

Distribution—Belgium, Czech Republic, Estonia, Finland, Lithuania, Mordovia, North Caucasus, Poland, and Ukraine (Urbanavichene & Urbanavichus 2014). This is a first report of *B. pycnidiata* for India.

Malmidea nigromarginata (Malme) Lücking & Breuss, Lichenologist 47: 19. 2015. Pl. 1b

Thallus crustose, epiphloeodal, smooth, grayish black, medulla ochraceous, K+ yellow; borderline blackish. Apothecia mostly solitary,

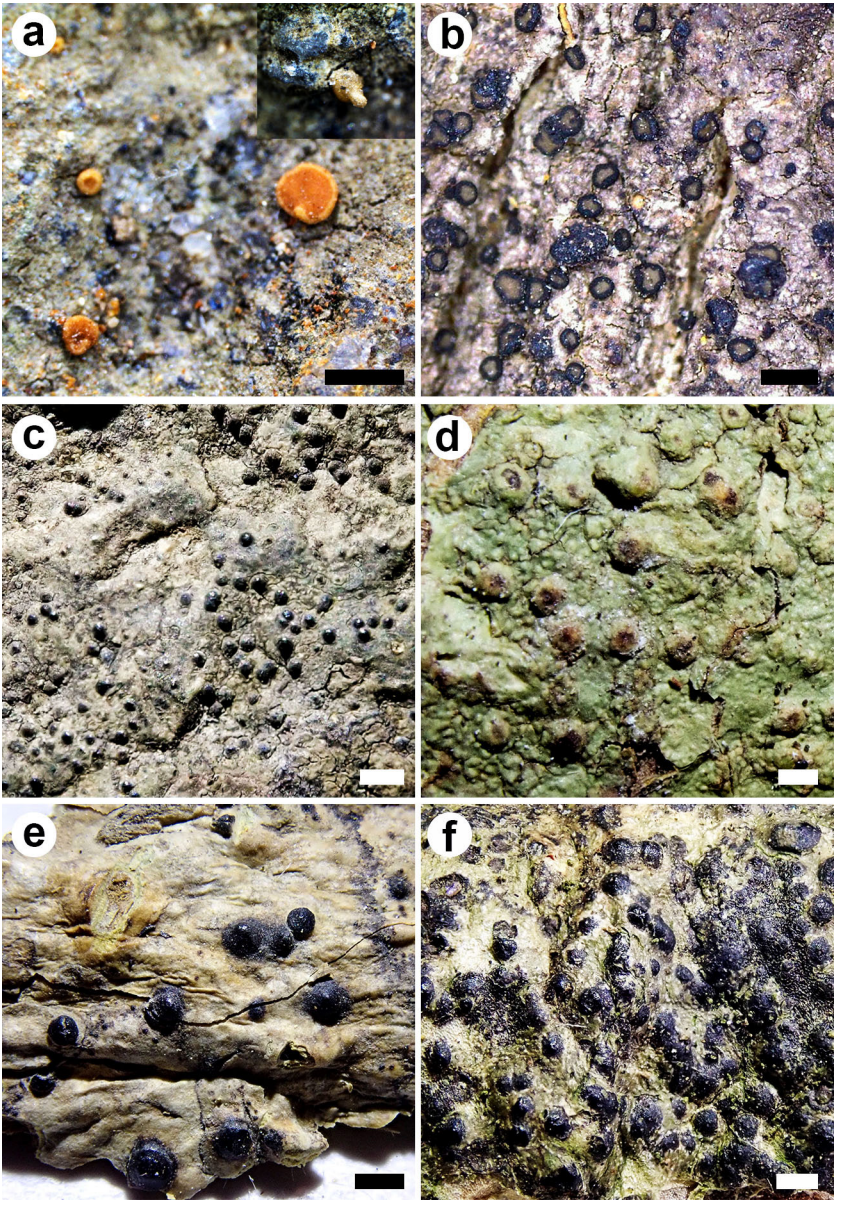

Plate 1. Habit. a. ***Bacidia pycnidiata*** (LWG 35885); b. ***Malmidea nigromarginata*** (LWG 35887); c. ***Porina malmei*** (LWG 35886); d. ***Porina nuculastrum*** (LWG 35888); e. ***Pyrenula laetior*** (LWG 35889); f. ***Pyrenula wrightii*** (LWG 35890). Scale bars = 1 mm.

rarely 3–4 aggregated, margin black, disc flesh coloured. Excipulum without algal cells, lacking medullary layer, hyphae radiating and conglutinated. Hymenium hyaline, 70–90 µm high, I+ blue. Hypothecium dark brownish to brown black, 70–100 µm thick. Asci 6–8-spored. Ascospores simple, hyaline, 8.9–13.4 × 4.5–5.4 µm.

Chemistry—Thallus K–, C–, P–, UV–; no lichen substances detected in TLC.

Specimen examined—**INDIA**, **Assam**, **Nagaon district**, Samaguri, Chapanalla, 26°19′13″N 92°54′16″E, elev. 119 m, on bark, 18 February 2018, Rupjyoti Gogoi NCLH 030 (LWG 35887).

Remarks—The ascospore sizes of the Indian specimen fit well within the range of *Malmidea nigromarginata* (10–14 × 4–6 µm) as mentioned in the world key to the genus by Breuss & Lücking (2015).

Distribution—Nicaragua (Breuss & Lücking 2015) and Puerto Rico (Mercado-Díaz & al. 2015). This is a first report of *M. nigromarginata* for India.

Porina malmei P.M. McCarthy, Biblioth. Lichenol. 52: 70. 1993. Pl. 1c

Thallus saxicolous, medium to dark grey, areolate, ecorticate. Perithecia emergent, hemispherical to subglobose, dull black, 0.1–0.3 mm diam. Ostioles apical, conspicuous. Involucrellum brownish, continuous with the exciple. Excipulum black, 20–50 µm thick. Centrum 0.15–0.25 µm wide. Hymenium clear. Asci elongate-cylindrical. Ascospores hyaline, fusiform, (3–)6–7-septate, 20–27 × 4–6 µm. Pycnidia not seen.

Chemistry—Thallus K–, C–, P–, UV–; no chemicals detected in TLC.

Specimen examined—**INDIA**, **Assam**, **Tezpur**, Rudrapad Temple, bank of River Brahmaputra, 26°36′55″N 92°46′10″E, elev. 65 m, on rock, 16 March 2015, Manas P. Choudhury 15027003 (LWG 35886).

Remarks—The Indian specimen agrees with the description of Australian *Porina malmei* in most features, and ascospore lengths fit well within the 17–30 µm range cited in the protologue (McCarthy 1993).

Distribution—Brazil, north-eastern Australia (McCarthy 2000). This is a first report of *P. malmei* for India.

Porina nuculastrum (Müll. Arg.) R.C. Harris, More Florida Lichens, incl. 10 Cent Tour Pyrenol. (New York): 174. 1995. Pl. 1d

Thallus crustose, epiphloeodal, olivaceous, slightly rimose, prothallus black. Perithecia erumpent to ± immersed, mostly solitary, rarely grouped into 2–3, perithecia concolorous with the thallus except in the peri-ostiolar and ostiolar regions, convex to sub-globose 0.4–0.65 mm diam.; ostiole inconspicuous or

in a shallow depression; peri-ostiolar area 0.12–0.18 mm diam. Involucrellum enclosing the exciple yellowish to blackish. Exciple ca. 30 µm thick. Hymenium clear. Asci elongate-cylindrical. Ascospores narrowly ellipsoidal to fusiform, submuriform to muriform with 6–10 transverse septa and (0–)1(–3) longitudinal septa, 49.8–67.6 × 13.5–22.2 µm. Pycnidia not seen.

Chemistry—Thallus K–, C–, P–, UV–; no chemicals detected in TLC.

Specimen examined—**INDIA**, **Assam**, **Nagaon district**, Samaguri, Suang Reserve Forest, 26°19′20″N 92°54′18″E, elev. 142 m, on bark, 18 February 2018, Rupjyoti Gogoi NCLH 031 (LWG 35888).

Remarks—The Indian specimen closely matches the Australian and Vietnamese descriptions of *Porina nuculastrum* (McCarthy 2001, Joshi & al. 2019), except that our ascospores have fewer transverse septa.

Distribution—Neotropics, Madagascar, the Philippines, Hong Kong and neighbouring countries (McCarthy 2001), Vietnam (Joshi & al. 2019). This is a first report of *P. nuculastrum* for India.

Pyrenula laetior Müll. Arg., Bot. Jahrb. Syst. 6: 413. 1885. Pl. 1e

Thallus crustose, corticate, epiphloeodal, yellow, without external pigments. Perithecia black, solitary, 0.4–0.9 mm diam. Ostiole apical without pigment. Hamathecium inspersed with oil droplets. Asci 8-spored. Ascospores brown, 3-septate, eciliate, distoseptate, lumina in a straight line, 13.8–19.2 × 5.8–7.7 µm, central lumina not strongly elongated, terminal lumina separated from the exospore wall by endospore thickenings, old ascospores without orange oil.

Chemistry—Thallus K–, C–, P–, UV–; no chemicals detected in TLC.

Specimen examined—**INDIA**, **Assam**, **Nagaon district**, Samaguri, Suang Reserve Forest, 26°19′20″N 92°54′18″E, elev. 143 m, on bark, 18 February 2018, Rupjyoti Gogoi NCLH 032 (LWG 35889).

Remarks—Aptroot (2012) cites ascospores ranging from 13–18 µm for *Pyrenula laetior,* while those of the Indian specimen are slightly longer. The Indian material agrees with *P. laetior* in all other characters.

Distribution—Neotropics (Aptroot 2012), Vietnam (Joshi & al. 2018). This represents a first report of *P. laetior* for India.

Pyrenula wrightii (Müll. Arg.) R.C. Harris,
More Florida Lichens, incl. 10 Cent Tour Pyrenol.: 111. 1995. Pl. 1f

Thallus corticolous, epiphloeodal, olive green with pseudocyphellae. Perithecia black, without external pigments, solitary to mostly aggregated with separated ostioles, 0.2–0.5 mm diam. Ostiole apical without pigment.

Hamathecium not inspersed with oil droplets. Asci 8-spored. Ascospores brown, 2–3-septate, 27.3–33.2 × 12.5–14.5 µm, lumina in a straight line, external lumina separated from the exospore wall by endospore thickening.

Chemistry—Thallus K–, C–, P–, UV–; no lichen substance detected in TLC.

Specimen examined—**INDIA**, **Assam**, **Nagaon district**, Doboka Circle, Jamunamukh, 26°05′54″N 92°44′44″E, elev. 40 m, on bark, 5 February 2017, Rupjyoti Gogoi NCLH 033 (LWG 35890).

Remarks—The Indian specimen agrees with the published description of *Pyrenula wrightii* by having pseudocyphellae and in ascospore characteristics (Aptroot 2012). The ascospores of the Indian specimen are slightly longer than the measurements provided in the basionym protologue (27–30 µm; Müller 1885).

Distribution—Cuba (Aptroot 2012). This represents a first report of *P. laetior* for India and the first outside the type country.

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